

# Teacher Information

## Solar Events

### I. OBJECTIVES

#### A. Forming Concepts (Introductory) Objectives

1. Define coronal holes, solar flares, aurora, and geomagnetic storms.
2. Explain solar events' effects on radio communication.
3. Explain solar events' effects on satellites' orbits and function.
4. Explain solar events' effects on navigation.
5. Explain solar events' effects on power grids and pipelines.

#### B. Interpreting Data Objectives

1. Describe the relationship between X-ray radiation and anomalies of Earth's magnetic field.
2. Describe the relationship between the sunspot number and the number of days with geomagnetic storms.
3. Interpret a graph to determine the months of most and least average geomagnetic storm activity.
4. Interpret a data set of yearly sunspot numbers to determine the year of the solar minimum with the smallest sunspot number.

**Objectives 5 through 8 require a working knowledge of exponential notation. If your students have not covered exponents, skip section III E.**

5. Calculate the magnitude of the sun's gravitational pull relative to Earth's.
6. Convert the solar escape velocity to kilometer per hour.
7. Calculate the diameter of the sun.
8. Calculate the rotational speed of the sun in kilometers per hour.

### **C. Applying Principles Objectives**

1. Explain observations of the average sunspot number.
2. Justify the cost of an early warning system for geomagnetic storms.
3. Explain the international nature of solar event problems.

## **II. Interdisciplinary Uses**

### **A. Social Studies**

1. Explain the adverse economic effects on people that can be caused by solar events.
2. Describe ancient cultures' use of the sun for measuring time.

### **B. Math**

**All calculations are contained in section III E. This section requires a working knowledge of exponential notation. If your students have not covered exponents, skip section III E.**

1. Calculate the magnitude of the sun's gravitational pull relative to Earth's.
2. Convert the solar escape velocity to kilometers per hour.
3. Calculate the diameter of the sun.
4. Calculate the rotational speed of the sun in kilometers per hour.
5. Calculate by using exponential notation.

### **C. Language Arts**

1. Write short essays about solar events' effects on people.
2. Read and write poems and stories about the sun.

### III. Science Standards Coordination

The Solar Events activity has been designed to incorporate science standards as specified by the National Science Education Standards (NSES) and the National Science Teachers Association (NSTA) Scope, Sequence, and Coordination (SS&C) of Secondary School Science. Only the major topics are listed. For Further explanation of each standard see the complete documents:

NSES-National Academy Press, 2101 Constitution Ave, NW,  
Washington, DC 20481

NSTA - 1840 Wilson Blvd, Arlington, VA 22201-3000

<u>NSES</u>	<u>SS&amp;C</u>
structure of the Earth system	thermal energy
Earth in the solar system	Earth-Moon-Sun system
transfer of energy	sun as an energy source
properties and changes of properties in matter	solar system in space

### IV. Advanced Preparation

#### A. Materials

1. One computer per three or four students
2. One copy of the student activity book for each student or group of students

## **B. Time required to complete the activity**

1. Get Info takes about 30 minutes.
2. Gather Data takes about 30 minutes if your students are accomplished at exponential notation or if you skip section III E.
3. Applying Principles takes about 10 minutes.

## **C. Teacher Familiarity**

Preview these materials thoroughly. As with all these activities, before using this activity in class, review the sites and work through the activity yourself to learn about sunspots so you can answer questions or direct the students to the answers.

The activity is set up so the students are taken to the pages that contain information that will be used to answer questions regarding solar events. The sites contain either the answers or the information from which the students can infer the answers. At the end of the activity, there is a list of enrichment activities and related web sites.

## **D. Select questions for students to answer.**

It would be prudent for you to read the questions students will be expected to answer. These questions are in order of ascending difficulty. Depending on grade level and ability level, you might want to assign specific questions for your students.

## **E. Student Grouping**

These activities can be done individually or in small groups of up to four students. They can also be done at home for extra credit by students who are on-line at home.

## **F. Software Requirements and Duplication Preparation**

1. Download Adobe Acrobat viewer for your platform (Mac or PC).
2. Download this instructor manual and the student activity book pages from the USA sunspots introductory page.
3. Duplicate and distribute student pages. Each student should have a copy of the student activity book. Ideally, the student activity book should be distributed and discussed the day before the activity.